OBSERVATIONS

ON THE

VEGETABLE PARASITES

INFESTING THE

HUMAN SKIN.

BY

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Further Observations on the Vegetable Parasites, *particularly those infesting the* Human Skin. By Jabez Hogg, F.L.S., M.R.C.S., &c.

(With Plates III & IV.)

(Read Nov. 8, 1865.)

Mr. President,—Since you did me the honour to ask for a contribution to the 'Transactions of the Microscopical Society' during your term of office, I thought I could not better engage an evening than by putting together a short account of some further observations I have been making, during the recess, on the identity of the parasitic fungi infesting the human skin. And I must request the members to receive the few remarks I am about to make as a continuation of the investigations I communicated to the Society at the end of 1858, and which were published in our 'Transactions,' January, 1859, wherein I endeavoured to show the true character of the so-called parasitic diseases of the skin, their common origin and identity, and also the universal distribution of these parasites throughout nature.

You will, I am sure, pardon a small degree of vanity, when I say that it is exceedingly gratifying to me to find that the publication of the paper just referred to seems to have been the cause of directing the attention of other observers to this very important subject; and by the labours of scientific men diseases of the skin have been gradually rescued from the hands of the empiric. They are now acknowledged to be consitutional rather than local affections, and a simpler and more effectual method of treatment for the cure of some of the greatest ills that flesh is heir to, is distinctly pointed out, and at once resorted to. But whether future investigations will tend to confirm an opinion now gaining ground, to the effect that the poison-germs which produce the most alarming infectious diseases are likewise of a *fungoid nature*, I am not at all prepared to say. But of this we may be quite certain, that it is only by the aid of the microscope, in the hands of those who will patiently sit themselves down to interrogate nature, "that we can ever expect to make out the character of those poisons which, generated in one body and conveyed to another, produce such terrible destruction to our race."* For these microscopic germs, in-

* Dr. Beale, in a highly valuable series of lectures "On the Passage of Germinal or Living Matter from one Organism to another," published in the 'Medical Times and Gazette,' 1864, enters into the question of contagion. He believes that when *germinal matter* has its powers of growth perverted or

visible though they be to the unaided sight, are nevertheless produced in myriads in the earth, air, and water around us, and are so diminutive that ordinary motes floating about in the atmosphere are large in comparison. And when we reflect on the very remarkable powers of life possessed by all —and the fungi in particular—which are found to resist a moist heat equal to that of boiling water, and also an intense frost, without at all losing their powers of germination, we can no longer feel surprised that their spores are found penetrating the hairs of the head or the hair-follicles and epidermic cells of the body; nor, indeed, that they should penetrate the internal parts, even where the hard textures, the bones, do not escape their destructive influence. For the very reason that these pests, botrytaceous or myeodermatous fungi, are found both upon the external and internal surfaces, it is proposed to divide them into *Epiphytes* and *Entophytes*.

Although, as I have before pointed out, it is not possible that in either of these cases fungi originate disease, it is pretty certain that they frequently aggravate it, and once let the spores establish themselves on any part of the body where secretion is not sufficiently active or healthy, and it is a difficult matter to throw off the intruder.

These, then, were exactly the conclusions I had arrived at seven years ago, and since this subject has engaged the attention of our countrymen, it appears that men who are deservedly eminent on the Continent have been led to examine into the truth of these researches, and the result has been that Bazin, Hebra, and others, have considerably modified their views and reduced the number of species.

It will, however, assist our investigation if I enter very

degraded, it may obtain a power of indefinite multiplication, like the pus of an abscess or the secretion from purulent ophthalmia. Such pus, that is, such degraded germinal matter, he has shown to have the power of independent growth under various conditions, and to be capable of maintaining its vitality for long periods, if not completely deprived of moisture. When introduced into another animal's body, offering favorable conditions, it increases and multiplies. It would appear, then, that the growth of ill-conditioned germinal matter may be accompanied by the development of poison in the organism that supports it; just as the growth of mould changes the quality of bread, or cheese, or other substance, on and in which it is found. He does not, however, assume the existence of spores or other bodies, whose presence he has not yet discovered, but appeals rather to the germinal matter whose existence and growth he has demonstrated; and although he does not look for the extinction of all contagious diseases, yet he does expect that much good will be derived from keeping the body in an unsusceptible state —by living in good and pure air, by dryness and plenty of sunlight, and especially by general cleanliness, as preventives of these forms of disease.

briefly into the early history of the parasitic diseases, and their recognised division into species.

It is now more than a quarter of a century since Bassi, of Milan, discovered the vegetable character of a disease which caused great devastation among silkworms; and, about the same time, Schönlein, of Berlin, was led to the detection of certain cryptogamic vegetable formations in connection with skin diseases. The observations of this distinguished man have been abundantly confirmed by Gruby, Remak, Robin, Küchenmeister, Bennett, Jenner, and others, most of whom attempted to identify the fungus with the disease which they believed to be produced by it, and in this way separate and detach some of the most common skin diseases from the rest, and so regard them simply and almost exclusively as *fungoid or parasitic diseases.* Thus, the parasite supposed to be peculiar to, and productive of, each disease has been minutely described, and honoured with a name derived from the name of the disease which it is supposed to have originated, as appears in the following table:

Willan.	Bazin.	Wilson.	Parasite.
Porrigo favosa and lupinosa	Tinea favosa	Favus	*Achorion Schönleinii.*
Porrigo scutulata	Tinea tonsurans	Trichosis furfuracea	*Tricophyton tonsurans.*
Porrigo decalvans	Tinea decalvans	Alopecia	*Microsporon Audouini.*
Mentagra	Tinea sycosa	Sycosis	*Microsporon mentagraphytes.*
Pityriasis versicolor	Pityriasis	Chloasma	*Microsporon furfur.*

Now, this very tempting theory involves an important principle of pathology, inasmuch as it places the parasitic fungi above described in a category by themselves, and invests them with characteristics entirely at variance with those of the natural history of the family of fungi, whose leading feature appears to me to be that of selecting diseased and decayed structure as the soil most essential to their existence; whereas this hypothesis assigns to them healthy organized matter to live and prey upon, and thereby establishing specific diseases. In examining into the truth or fallacy of this theory by the light of physiology, we must bear in mind that the surface of the human body is supplied with a delicate covering, one office of which is to excrete, and another to eliminate or exude, effete matter from the

blood. The exeretion eonsists ehiefly of epithelial sealcs, and the exudation is mostly made up of fluid and gaseous matters, whieh sometimes beeome condensed and dried on the surfaee of the epidermis. The epithelial scales are friable and separable by very light frietion during health, and the transpired fluid makes its free escape, under ordinary circumstanees, without any assistanee from without. But want of cleanliness, defieient exereise, and mueh more frequently a deranged state of the health, espeeially a vitiated condition of the body, interfere with the natural proeesses of elimination; and then the skin itself beeomes diseased, and in this diseased eondition may beeome infested by parasitic fungi, the spores and filamentous threads of whieh find a nidus in an abraded portion of the eutiele; or, what is more generally the ease, the shafts and roots of the hairs are invaded, the hairs beeome brittle and stunted in growth, and at length perish and fall off.

Dr. Tilbury Fox, who in 1863 published an excellent work on 'Skin Diseases of Parasitie Origin,' was the first to eall the attention of the profession to a point of eonsiderable praetieal value in eonjunction with parasitie growths, namely, that whenever we find a fungus in eonneetion with a skin disease we must look upon it as a something superadded to the diseased eondition—"a eomplex condition, an eruptive disease *plus* a tinea" (parasite). By taking this definition as our guide, we may say without hesitation that "the pathognomonie sign of parasitie disease of the surfaee is the infiltration and destruetion of the hairs by the spores; and the diagnosis ean in nowise be eonsidered perfeet until spores or myeelia have been deteeted by the mieroseope." For the future, then, we must look upon parasitie disease as *non*-existent without this test. I eannot, however, admit that this eomplex eondition at all invalidates, as Dr. Fox would seem to imply, the opinion expressed by me in my former paper, namely, *that the growth of a fungus is not necessarily pathognomonic of any special form of skin disease;* nor do I quite think, with him, that the eomplex eruptive condition is so entirely of a seeondary eharaeter simply beeause in *tinea decalvans* we sometimes find the parasite in the perished and falling hairs unaccompanied by any eruption of the skin. In the course of my experienee, which appears to slightly differ form Dr. Fox, I happen to have seen in my friend Mr. Hunt's praetiee eases of alopeeia, syeosis, porrigo decalvans, &e.,* with a sealy desquamation preeeding the perishing and falling of the hairs, and at the same time unaeeompanied

* See former paper, Vol. VII, 'Quart. Jour. Micro. Science,' 1859.

by parasitic growth; therefore I still believe that an eruptive condition of an abraded secreting surface is a very necessary part of the disease, and that then the skin affords a more particularly favorable soil for the development of the fungus; but leaving this part of the subject for the present, I shall proceed to show in an experimental and, I trust, a satisfactory way that the same species of fungus often exhibits varieties of character, as well as form, at different stages of development and under varied influences; so much so, "that neither size nor outline affords any basis for distinction into species until it has been ascertained, from extensive comparison of forms brought from different localities in the widest area over which the species can be traced, what are the average characters of the type, and what their range of variation." (Bentham.)

First, with regard to collecting and taking fungi, I find that the prevalence of damp or moist close weather is especially favorable for the purpose; while in an opposite condition of the atmosphere—fine frosty weather—I have rarely been able to secure a supply; and, moreover, my experience has proved to me that in the winter season diseases of the skin accompanied by parasitic growth almost disappear from among the poor who frequent our skin infirmaries. Mr. Hunt also finds that season brings with it its own peculiar type of skin disease.

It appears that at particular periods of the year the atmosphere is, so to speak, more fully charged with microscopical atoms than it is at others. The spores of the moulds *aspergilli, penicillia,* and *puccinia,* are perhaps the most widely distributed bodies, and towards the end of the hot weather, or about autumn time, they are very abundant. Among those who have taken them at this period of the year we must ever associate the name of one of our body, the Rev. Lord Godolphin Osborne, who, I believe, first experimented in this way during the cholera visitation of 1858. He exposed prepared slips of glass, slightly moistened with glycerine, over cesspools, gully-holes, &c., near the dwellings of those where the disease appeared, and caught, what he named *aërozoa*—chiefly minute germs and spores of fungi. I was favoured with a few specimens, one of which I have placed under a microscope on the table for the purpose of comparison with the more recent specimens taken by myself two months ago; a drawing made from this (see plate IV, fig. 4) exhibits spores almost identical with those found in the skin, &c.

From the year 1858 to the present time I have amused myself by catching these floating atoms, and, so far as I can

judge, they are found everywhere, and in and on every conceivable thing, if we only look close enough for them. Even the open mouth is an excellent trap; of this there is ample evidence, since we often find on the delicate membrane lining the mouth of the sucking, crying infant, and on the diphtheritic sore throat of the adult, the destructive plant *Oïdium albicans*. The human or animal stomach is invaded, and in a certain deranged condition we find the *Sarcina ventriculi*, with its remarkable-looking quaternate spores, its torulæ, &c., seriously interfering with the functions of this organ. I may mention a curious fact in connection with stomach fungus, the discovery of Lehmann, namely, if an emulsion of casein (the casein of sweet almonds) be mixed with a small quantity of amygdaline and then introduced into the stomach of the animal, it very soon ferments, and the yeast-fungus quickly changes the chemical constituents of the mass into the poisonous substance *oil of bitter almonds*, and thus destroys the life of the animal.

In specimens of the vomit from another fearful disease, the *yellow fever*, sent to me from Bermuda, I found a large admixture of spores and torulæ, with altered blood-corpuscles and disintegrated epithelial scales.* Here, then, we have striking examples of the ravages committed by the fungi, but I think no one will say we are justified in attributing either fever, thrush, or diphtheria, to the presence of the Oïdium found in connection with these diseases. I might go on multiplying examples of a similar kind; but as that would inconveniently extend my paper, I will rather proceed to give the results of experiments made with the *favus* fungus taken from the human body.

At the time I read my former paper I was unable to show the result of any examination, or, indeed, make more than a passing allusion to favus, although a well-known form of disease, from the circumstance of its having attracted the attention of Schönlein, who found a fungus growth always

* My own observations on the presence of fungi in these vomits receive confirmation from Dr. Buchanan, who was sent by the Privy Council to make inquiries into the outbreak of yellow fever at Swansea last September. Upon making a microscopical examination of the vomits he discovered large quantities of fungus-spores, changed blood-cells, &c. Last year I met with fungus-spores in the chamber of the eye, a still more remarkable portion of the human body, than any above alluded to. A man fifty years of age, came to me complaining of impairment of sight. His attention was first directed to the defect by the very unusual appearance of a small "plant-like body" always before him. By a careful examination of the eye with a magnifying ophthalmoscope I was quite able to satisfy myself of the presence of a small group of puccinia spores in the vitreous humour.

mixed with favus crusts. The disease is one commonly known as *cupped ringworm*, or honeycomb scall, and is now rarely seen in this metropolis; therefore I consider myself fortunate in having been able, through the kindness of my friend Mr. Hunt, to investigate three cases, from each of which I collected scales for microscopical examination. I have here a few of the peculiar-looking crusts, and it will be observed that they are cupped in appearance, and of a dingy yellow colour. The crust is almost entirely composed of the *Achorion*, mixed with epithelial scales and broken hairs. When the fungus once establishes itself, so fearful are its ravages that in a very short space of time the whole of the cutaneous surface, with the exception of the palms of the hands and soles of the feet, becomes covered with it. I attempted to obtain a photograph of one of the patients, but cannot say very successfully; the print gives but a faint idea of the disagreeable picture really presented to the sight. Large masses of crusts fall off daily, each one leaving its mark behind. As the spores penetrate the hair-follicles they destroy the sheaths of the hairs, which shrivel up and lose their colouring matter, and then break off, leaving the surface bald.

The fact of the surface becoming so entirely denuded is explained in this way:—The shaft of the hair is less in circumference than the bulb, and consists of hardened, shrunken epithelial scales, almost devoid of germinal matter; and the further removed from the bulb, the less of vital power does it possess, and consequently, when its nutrient supply, small even at first, becomes interfered with and lessened by the increasing spores, it loses the little vitality it ever had, dies, and drops off. In this, as in other cases, the fungus feeds upon the dead, and not the living, material.

If we now take a crust and examine it more closely, it will be seen to be made up of an outer and older part, thick and dark in colour, the fungus being here in a more advanced stage, and chiefly composed of sporangia, spores, and mycelia, with fragments of several hairs imbedded in them. The under or inner and younger layer is paler in colour, and consists of spores mixed with epithelium, fatty and granular matters, and sometimes pus; and I suppose we may consider that in some cases a very large quantity of the latter ingredient (pus) has been mixed up with the outer parts of the crusts. Mr. Wilson started a new theory, founded on this exceptional condition, namely, *"that the favus matter is produced from the development of the nuclei of pus-cells;" that the parasite is not a vegetable, or that, if it be, it might be*

looked upon as an example of the conversion of an animal into a vegetable product. It is quite possible, without a carefully made microscopical examination, to mistake the stroma, always present in large quantities in favus crusts, for pus. This, I think, is a mistake often committed by the more casual observer. We will not, however, enter into any discussion upon this theory, nor upon one still more improbable, "the spontaneous generation hypothesis"—of all hypotheses the most gratuitous; I was almost about to say *absurd.*

I must now be permitted to add a few words upon the physical aspect of persons suffering from *favus,* because, as I have already stated, and not without proof, that such diseases are the embodiment, or rather the impersonification, of a weakly, unhealthy state of the body, well understood as the scrofulous habit; and associated with a dirty or neglected state of the skin in the majority of cases. Hebra, the great authority on skin diseases, lays much stress upon the feature of *dirtiness* as a cause of favus, and goes so far as to say that this accounts for its rarity among the upper classes of society. "The subject of one of the worst cases," says Mr. Hunt, "was a puny, half-starved boy of seventeen, whose appearance was that of a child of nine or ten. When he was taken from his miserable home into purer air, and well fed, the crusts died and dropped off; but when he returned to the wretched habitation of his parents, situated in one of the filthiest parts of Lambeth, and was insufficiently fed, the vegetation grew again most rapidly—flourishing in the vitiated fluids like a vine in a mass of stercoraceous mould." From this boy I obtained, in 1859, large supplies of the fungus crusts, and at that time, to make sure of the results of my examinations, I sent portions of the same to friends upon whose experiments I could rely for the confirmation of my own. Having perfectly satisfied myself, and not by one but by many trials, that the achorion (favus) produces as good a ferment, and nearly as briskly, as healthy yeast, when added to barley-wort, with only a slight difference of size and form, "a difference of degree, and not of kind," my next experiment was one slightly varied, for the purpose of observing the modifying influence of light over these fermentations, and at the same time ascertaining if this agent at all affected the character of the results. I was, perhaps, led to make this observation from finding that yeast requires for its more perfect growth, not only a proper temperature, but almost occlusion from daylight—a fact that appears to hold good in the development and growth of most fungi. I therefore, in April last, procured a supply of fresh wort from a brewery,

which I divided into three equal portions, and, for the sake of convenience, numbered 1, 2, and 3. Into Nos. 1 and 2 I put a few favus crusts; No. 1 was put carefully away in a darkened place, the temperature of which was about 70° Fahr.; Nos. 2 and 3 (the latter being simply sweetwort only) I exposed to a good light in my sitting-room window, where the temperature ranges from 65° to 75° Fahr.; each bottle was closely corked. On the second day, upon examining a portion of 1 and 2 with a $\frac{1}{4}$-inch power, I found fermentation had commenced, a film spreading over the whole surface of the liquid. In No. 1 were seen a fair quantity of yeast-cells, varying in form and size; shown in Pl. III, fig. 1, *a*. No. 2 was in a more advanced stage, and some of the spores were rather larger than in No. 1. On the 4th and 5th days I took portions from all three bottles. That from No. 1 gave the best results; the spores, yeast-cells, were more numerous and spherical in form, well filled with granular matter and numerous moniliform chains of smaller spores and amorphous stroma, shown in fig. 1, *b*. Compared with a small portion of fresh yeast from a beer-barrel, fig. 3, the cells and spores appeared about half the size (in the drawing, however, these are represented too small). In specimen No. 2 spherical cells were fewer and smaller, with groups of ovoid spores mixed with torulæ, and bacterium-like bodies, which were floating rapidly about; here and there were seen tufts of penicillium, represented in fig. 2, *a*. In specimen No. 3 were numerous ovoid spores, without granular matter, highly refractive, and not unlike fat-globules.

On the tenth day the changes seen in specimens taken from each bottle were still more marked. From No. 1 the spores were more numerous, but certainly rather smaller, and variable in form, and the greater portion of them were filled with granular or nuclear matter; there were also groups of torulæ mixed with still smaller spores, fig. 1, *c*. This specimen, when the cork was removed from the bottle, gave indications of the presence of carbonic acid, the odour was that of good fresh beer, and the greater portion of the heavy yeast had fallen to the bottom of the bottle. No. 2, on the contrary, had become quite of a dark colour, smelt sour, and the spores had much decreased in size, granular matter with bacteria being by far the more numerous; represented in fig. 2, *b*. The wort in No. 3 was still sweet—of a somewhat vinous sweetness—and the top was thickly covered over by a whitish, flocculent, filamentous-looking mass of mould.

A fortnight or rather more elapsed, and then another examination gave somewhat similar results. No. 1 was still per-

fectly sweet, while No. 2 was more sour, and of a dark red colour; the filamentous masses were broken up, and had fallen to the bottom of the fluid, and the surface was slightly covered with a mould. No. 3, although smelling somewhat like bad wine, was not much altered in colour, but on its surface aspergillus was growing. Six months later No. 1 was perfectly sweet, exhibiting well-marked spores and torulæ; No. 2 was rather more decomposed than it was on the former examination; and No. 3 remained the same.

Now, upon comparing the fermentation of the achorion fungus with that of good healthy yeast, it will be seen to be almost identical. In the first place, it is as actively carried on by the former as by the latter. There is, however, just a slight difference in the size of the spores or cells already mentioned, those from yeast being the larger and more nearly spherical, with a greater number of reproductive spores, that is, cells with a single, clear, nucleated cell in their interior, while others are filled with a darker granular matter, and having only a slight tendency to coalesce or become filamentous; while the achorion are for the most part ovoid and very prone to coalesce and produce elongated cells or torulæ. Now, with reference to the slight difference in size, we must look upon this as a matter of very little importance; for to the presence of light in the one case, and its almost total exclusion in the other, this difference, I have no doubt, is almost entirely due. It would be more trustworthy if comparisons of this kind could be made at the same stage of development; for be it remembered that yeast obtained from a brewery is in a more favorable state, inasmuch as it is stopped at a certain stage of growth or development, and then *set* to begin its fermentation over again in fresh supplies of a new pabulum, which gives increased health and vigour to the plant; while, on the other hand, the achorion, or favus fungus, is obtained and used in an exhausted state from an already ill-nourished or starved-out soil. Neither can we attach much importance to differences in size and form of the spores, for even this occurs in yeast ferment; and although the ovoid is most frequently seen in achorion, it is equally common to yeast when exhausted. This is strikingly exhibited in Pl. IV, fig. 2, a drawing made from a drop of exhausted yeast taken from porter; here we have oval and elongated cells with torulæ. To ensure success in these and similar experiments, the fungus or yeast should be left floating on the surface of liquids; the process is either carried on very slowly or is entirely arrested by *submersion*.

Turpin and others, in their experiments on yeast, noticed

that the cells become oval and bud out in about an hour after being added to the wort; but this change depends as much upon temperature and density of the solution as upon the quality of the yeast. It is a well-ascertained fact that when yeast is added to distillery wash, which is worked at a higher temperature than brewers' wort, fermentation commences earlier, and the yeast-cell grows to a much larger size. It is, indeed, forced in this way much as a plant in a hothouse is, and then obtains to greater perfection in a shorter time. It will, however, be seen that it sooner becomes exhausted; and now, if we take a portion of this yeast, and add it to barley-wort, and at the same time keep it in a temperature of from 60° to 65° Fahr., it ferments languidly, and small yeast-cells are the product. If the yeast is allowed to stand in a warm place for a few days it partially recovers its activity, but never quite. With such a yeast there is always a good deal of torulæ mixed up with the degenerated cells, and sometimes a filamentous mass, which falls to the bottom of the vessel; from this stage it readily passes to that of *must* and *mildew*, and then becomes a wasteful feeder or destroyer.

With yeast already in a state of exhaustion I have seen a crop of fungus produced in the head of a strumous boy, seven years of age, who was much out of health, and had suffered from eczema of the eyelids, with impetigo. The disease had obstinately persisted in spite of well-directed efforts to remove it. The scabs were frequently examined, but no fungus found. The mother, by the recommendation of a friend, washed the boy's head every morning for a week with *stale beer*. I saw the child a few days after these washings were discontinued, and warm water only used to soak the scabs off. On placing portions of the broken hairs on a glass slip, and moistening with a drop of liquor potassæ, spores and torulæ were seen in abundance. Represented in Pl. III, fig. 4.

I have made frequent microscopical examinations since, with the same results. Two years have passed, and the disease remains uncured, although parasiticidical washings have had a fair trial. A change to country air and good diet always does more good than medicine in this case. I do not look upon this single experiment as at all sufficient to prove the production of the yeast fungus by transplantation into the human skin, although it is not very unlike the achorion fungus, or that of tinea tonsurans (*tricophyton*); but, taken with many negative trials that I made, to introduce both yeast and achorion into *perfectly healthy* skins, without any abrasion of

surface, I think it has an important bearing on the subject of my paper. At all events it is a fair illustration of change of type,* for when Mr. Hunt saw the boy, after the disease had persisted for at least twelve months, he at once pronounced it to be *pityriasis rubra* or *versicolor*. Had the fungus played any part in bringing about this change in the character of the disease.†

In another experiment I took portions of some *penicillia* and *aspergilli* moulds, and upon adding these to sweet wort I obtained results confirmatory of Dr. Lowe's,† which were pretty much as follows. Having placed small quantities of spores in the wort, I stood them by in a warm room. On the second day in one of the solutions, and on the third in the other, fermentation had fairly set in; the surface of the solution was covered with a film, which proved to be well-developed ovoid spores, filled with smaller granular spores (*conidia*) (fig. 5, Pl. IV). On the sixth day the cells changed in form and were more spherical. Again removing these to another supply of fresh wort, the results obtained were quite characteristic of exhausted yeast ferment.

Extreme simplicity of structure characterises all *moulds* or mildews. Their reproductive organs are somewhat more complex, but less understood; and although at first sight there is some difference in the appearances presented by their fruits, yet this is not sufficient to offer a basis for classification. Both in penicillium and aspergillus the mycelium

* The Rev. Mr. Berkeley, in his 'Outlines of British Fungology,' writes:—"It is not possible that in these cases fungi originate disease, though it is pretty certain that they frequently aggravate it." Nevertheless, after this clearly expressed and positive statement, we find, a few pages further on, the following contradictory assertion:—"That a few spores rubbed into the skin or inserted in it will soon produce the disease known as *porrigo lupinosa*" (favosa?). And he cites Dr. Lowe as his authority for this statement; but on looking over this gentleman's writings, what do we find? Why, that in the course of a somewhat extended inquiry into the causes of diseases of the skin he only met with two cases in brewers' draymen, and one in a dirty cellarman, of parasitic growths, with sycosis and favus, and which, he tells us, *commenced with a sore*. I would ask any one conversant with these diseases if this at all justifies the above assertion, or proves that the parasite can be communicated to, and grown upon, the *healthy* human skin. For my own part, so thoroughly satisfied am I of the utter fallacy of such a statement, that I should have no hesitation in submitting my own skin to be experimented upon.

† It is only right to say that *I did not follow* Dr. Lowe, as some writers have stated, in this field of inquiry. My observations on skin diseases were commenced at the suggestion of my friend Mr. Hunt, in 1856, and continued for three years before my first paper appeared in print. At that time, 1859, neither Mr. Hunt nor myself had heard of Dr. Lowe's researches, which, it appears, were communicated to a local society, and published in the 'Edinburgh Botanical Society's Transactions,' 1857.

terminates in a club-shaped head, bearing upon it smaller filaments with small bead-like bodies upon the apex, piled one upon the other, or, more properly speaking, *strung* together; these small bodies are termed *conidia;* these, again, are surmounted by larger spores of a discoid shape filled with granular matter, and others which are quite empty. Those of the aspergillus are mostly without granular matter or nucleated bodies, and are more highly refractive. The puccinia are club-shaped, and well filled with spores and spawn, while its ravages are mostly confined to our growing crops. It is the well-known *smut* or *rust*, the very rapid growth of the spores and spawn of which appear to exert a specific and peculiarly exhaustive action over the tissues of the plant on which it feeds.

The yeast plant, in its most perfect condition, is chiefly made up of globular vesicles, measuring, when fully grown, about the $\frac{1}{2500}$th of an inch in diameter. The older cells are filled with granular or nucleated matter; the nucleus rapidly increases, and nearly fills up the parent cell, which then becomes ovoid, and ultimately the young cell buds out and is separated from the parent. Sometimes other and smaller cells are formed within the young one before it leaves the parent globule. This process goes on most rapidly until the supply of food becomes exhausted; the vesicles, it would appear, derive their nourishment by the process of osmose, sucking in, as it were, certain portions of the organic fluid and chemically decomposing it, appropriating a part of its nitrogen and throwing off the carbonic acid. If, however, it is placed in any adverse condition, it becomes surrounded by layers of condensed material, resulting from the death of the germinal matter; ultimately a mere trace of life remains, which, taking the form of an impalpable powder, is free to be driven hither and thither with every breath of air.

From these experiments we may conclude that it matters little whether we take yeast, achorion, or penicillium spores, the resultant is the same, and depends much more on the food or nourishment supplied whether the pabulum contains more or less of a saccharine, albuminous, or nitrogenous material, lactic acid, &c., together with light and temperature; whether we have a mould (green or blue), an achorion or yeast fungus produced. Diversity of form in the cells, as well as quality and quantity of their material contents, is certainly due to, and in a manner regulated and controlled by, the beautiful law of *diffusion*, which admits, separates, sifts, and refines the coarser from the finer, the lighter from the denser particles, through the porous structure of the cell-wall.

In conclusion, I trust I have satisfactorily shown that—

1st. That there exists but one essential organism, a fungus whose spores find a soil common alike to the surface and the more secluded parts of the human or animal body.*

2nd. That variations in skin diseases associated with parasitic growth are due to differences in the constitution of the person affected; to the moisture, exudation, soil, and temperature, under which the development of the fungus takes place. Consequently it is neither correct nor desirable to separate and classify them as "*parasitic diseases of the skin.*"

3rd. That parasitic growths vary but little in any case, and then only in degree, not in kind, some soils appearing to be better suited than others for their development, that furnished by the eruptive or secreting surface being in every way the most congenial; while diversity of form, in all cases, arises from growth taking place either upon a sickly plant, a saccharine solution, or an animal tissue.

4th. That fungi generally excite chemical decomposition in the soils on which they feed, and it is the exclusive province of a certain class, when spread on the surface of an albuminoid, saccharine or alcoholic, or slightly acid liquid, to develope and grow, and during growth to give rise to either the alcoholic, acetic, or putrefactive fermentation.

* What part do the fungi, or bacteria, play in the production of that fearful scourge of the human race, *cancer?* is a question not infrequently asked of me, since in the first edition of my book on 'The Microscope' (page 394, 1854) I expressed a belief in "*the fungoid origin of cancer.*" Subsequent examinations of diseased structure more or less tend to confirm this view; it appears to me that in this disease we likewise have superadded a fungoid growth—"degraded germinal matter"—which, by its entrance into the circulation, produces a ferment and blood poisoning. The circular animal cell degenerates, and is converted into the ovoid or elongated vegetable cell; ultimately we have the whole structure of some organ changed into that remarkable-looking *caudate body*, the typical cancer cell. This in some instances bears the most perfect resemblance to certain spores of fungi, and to the yeast torulæ. As might be expected, its form is modified and its character more or less changed by the peculiar kind of nourishment and condensed tissue in which it is deposited and grows; its powers of growth are, so to speak, perverted and degraded, and then, as we see in other instances, it soon obtains a power of indefinite multiplication, and destroys, not only the vitality of the organ, but the individual. M. Davaine believes he has traced splenic disease in sheep to the entrance into the blood of *bacterium-like bodies*, or fungi—a zymotic disease caused by ferment, by the rapid growth of which the life of the animal is quickly sacrificed to the destroyer.

DESCRIPTION OF PLATES III & IV,

Illustrating Mr. Jabez Hogg's paper on Vegetable Parasites.

PLATE III.

Fig.

1, *a*.—Second day, specimen from No. 1. Favus-ferment in barley-wort, set aside in a darkened room. Yeast-cells, chiefly ovoid in form, with spores and a few epithelium-scales.

1, *b*.—Fifth day, specimen from No. 1. The yeast-cells more circular in form and larger in size. Spores and torulæ, with bacterium-like bodies in an active state.

1, *c*.—Tenth day, specimen from No. 1. Yeast-cells slightly degenerating, becoming more ovoid; torulæ and bacteria.

2, *a*.—Fifth day, specimen from No. 2, freely exposed to light. Small growth of yeast-cells, with spores and tufts of mycelia, penicillium, and a few large epithelium-scales; bacterium-like bodies not drawn.

2, *b*.—Tenth day, specimen from No. 2. Yeast-cells degenerating and disappearing; spores of mould, mycelia, and bacteria increasing.

3. —Healthy yeast-cells fresh from a porter brewery, drawn rather smaller than they measured.

4. —Portion of a scab taken from a boy suffering from eczema of eyelids and impetigo of scalp, showing spores, mouliform chains, torulæ, mycelium, and epithelium-scales.

PLATE IV.

1.—Fresh yeast transferred to a saccharine solution, and showing on the second day a tendency to degenerate.

2.—Degenerated or exhausted yeast taken from the bottom of a porter-vat; cells nearly all void, and torulæ abundant.

3.—Favus-fungus grown in a pure saccharine solution.

4.—*Aërozoa*. Spores with mycelium, &c., taken in the atmosphere during the cholera visitation of 1858.

5.—Penicillium-spores. Mould growing in saccharine solution.

6.—Aspergillus-spores growing in a saccharine solution.

7.—Puccinia-spores growing in a saccharine solution.

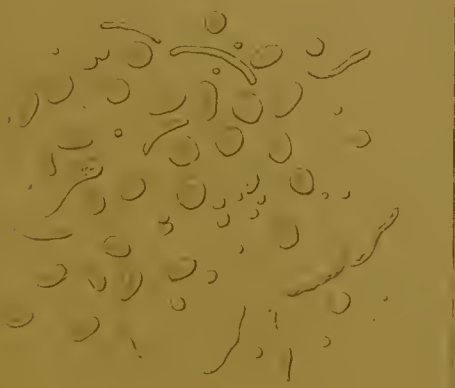
Magnified 400 diameters.


1a
1b
1c
2a
2b
3
4

1

2

3



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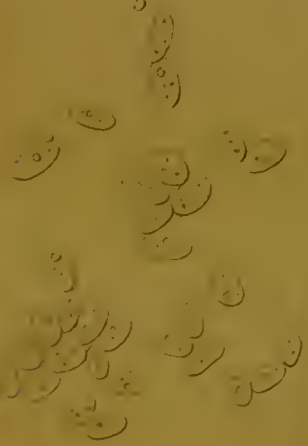

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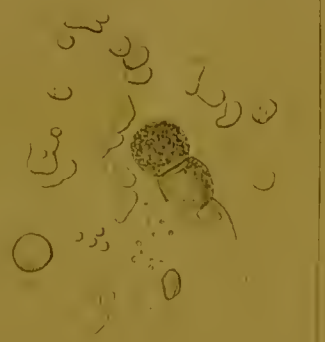

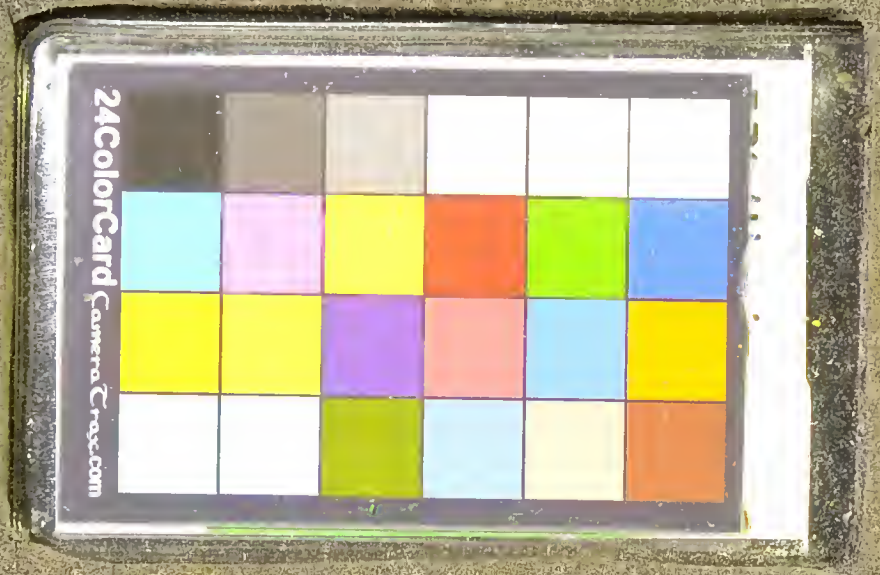
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